What is claimed is:

1. A fluid circuit assembly comprising:

a first fluid pathway,

a second fluid pathway, and

an element to hold the first and second fluid paths in overlapping alignment.

2. An assembly according to claim 1, wherein at least one of the first and second fluid pathways is defined between sheets of flexible material.

3. An assembly according to claim 1, wherein at least one of the first and second fluid pathways is formed by radio frequency sealing of flexible material.

4. An assembly according to claim 1, wherein the first fluid pathway includes an inlet to receive a first fluid, and wherein the second fluid pathway includes an inlet to receive a second fluid that is different than the first fluid.

5. An assembly according to claim 1, wherein at least one of the first and second fluid pathways includes an in-line valve region.

6. An assembly according to claim 5, wherein the in-line valve region is formed to present a channel width of no greater than about 0.4 inch.

7. An assembly according to claim 6, wherein the in-line valve region is defined between heat-sealed seams.

8. An assembly according to claim 7, wherein the heat-sealed seams present a channel width for the in-line valve region of no greater than about 0.4 inch.

9. An assembly according to claim 7, wherein the heat sealed seams are formed between sheets of flexible material having wall thickness, and wherein melted material adjacent the heat-sealed seams is generally less than twice the wall thickness of the flexible sheets.

10. An assembly according to claim 1, wherein at least one of the first and second fluid pathways includes an in-line pump region.

11. An assembly according to claim 10, wherein the pump region includes a peristaltic pumping element.

12. An assembly according to claim 10, wherein at least one of the first and second fluid pathways includes more than one in-line pump region.

13. An assembly according to claim 1, wherein at least one of the first and second fluid pathways includes an in-line fluid-receiving chamber.

14. An assembly according to claim 13, wherein the in-line fluid receiving chamber has a height of no greater than about 5 inches and a width of no greater than about 2.75 inches.

15. An assembly according to claim 14, wherein the in-line fluid receiving chamber has a height of about 3.6 inches and a width of about 1.2 inches.

16. An assembly according to claim 14, wherein the at least one first and second fluid pathway includes a flow bypass region communicating with the in-line fluid receiving chamber.

17. An assembly according to claim 16, wherein the flow bypass region includes a pressure relief valve.

18. An assembly according to claim 16, wherein the flow bypass region has an inlet formed to present a channel width of no greater than about 0.6 inch.

19. An assembly according to claim 13, wherein at least one of the first and second fluid pathways includes more than one in-line fluid-receiving chamber.

20. An assembly according to claim 1, wherein at least one of the first and second fluid pathways includes a region for sensing presence of blood.

21. An assembly according to claim 1, wherein at least one of the first and second fluid pathways includes a region for sensing temperature.

22. An assembly according to claim 1, wherein at least one of the first and second fluid pathways includes a region for sensing pressure.

23. An assembly according to claim 22, wherein the region for sensing pressure has an interior diameter that is greater than about 0.4 inch.

24. An assembly according to claim 1, wherein at least

one of the first and second fluid pathways is free of an air-fluid interface.

25. An assembly according to claim 1, wherein at least one of the first and second fluid pathways includes a pressure relief valve.

26. An assembly according to claim 1, wherein at least one of the first and second fluid pathways includes a flow bypass region.

27. An assembly according to claim 26, wherein the flow bypass region has an inlet formed to present a channel width of no greater than about 0.6 inch.

28. An assembly according to claim 26, wherein the flow bypass region includes a pressure relief valve.

29. An assembly according to claim 1, wherein the first fluid pathway includes a first in-line valve region that closes in response to exterior force, wherein the second fluid pathway includes a second in-line valve region that closes in response to exterior force, and wherein the element holds the first and second in-line valve regions in overlapping alignment for concurrent closure by external force.

30. An assembly according to claim 1, wherein the first fluid pathway includes a first in-line peristaltic pumping region, wherein the first fluid pathway includes a second in-line peristaltic pumping region, and wherein the element holds the first and second in-line peristaltic pumping regions in alignment for concurrent operative engagement with peristaltic

pump rotors.

31. An assembly according to claim 1, wherein the first fluid pathway includes a first in-line fluid-receiving chamber, wherein the first fluid pathway includes a second in-line fluid-receiving chamber, and wherein the element holds the first and second in-line fluid-receiving chambers in overlapping alignment so that fluid received in the first in-line fluid-receiving chamber displaces fluid from the second in-line fluid-receiving chamber, and vice versa.

32. An assembly according to claim 1, further including at least one external tubing communicating with at least one of the first and second fluid pathways.

33. An assembly according to claim 1, wherein the element comprises a frame holding the first and second fluid pathways.

34. An assembly according to claim 1, wherein the element comprises a cartridge holding the first and second pathways in overlapping alignment for mounting as an integrated unit on a fluid processing machine.

35. An assembly according to claim 34, further including at least one external tubing communicating with at least one of the first and second fluid pathways, and wherein the cartridge holds the tubing in alignment with the at least one first and second fluid pathway.

36. An assembly according to claim 1, wherein the first and second fluid pathways are configured to support a blood

processing procedure.

37. An assembly according to claim 1, wherein the first and second fluid pathways are configured to support a fluid exchange procedure.

38. An assembly according to claim 1, wherein the first and second fluid pathways are configured to support a fluid balancing procedure.

39. An assembly according to claim 1, wherein the first and second fluid pathways are configured to support a hemofiltration procedure.

40. An assembly according to claim 1, wherein the first and second fluid pathways are configured to support a hemodialysis procedure.

41. An assembly according to claim 1, wherein the first and second fluid pathways are configured to support a hemodialysis with hemofiltration procedure.

42. An assembly according to claim 1, wherein the first and second fluid pathways are configured to support a peritoneal dialysis procedure.

43. A method of processing fluid to and from an animal body comprising the steps of:

providing a fluid circuit assembly as defined in claim 1,

conveying incoming fluid removed from the animal body through the first fluid pathway, and

conveying a replacement fluid for the incoming fluid through the second fluid pathway, and

conveying the replacement fluid from the second fluid pathway to the animal body.

44. A method according to claim 43, wherein the conveyance of fluids through the first and second fluid pathways occurs concurrently.

45. A method according to claim 43, wherein the return of replacement fluid to the animal body from the second fluid pathway occurs, at least for a time period, in volumetric balance with the conveyance of incoming fluid from the animal body through the first fluid pathway.

46. A method according to claim 43, wherein the incoming fluid conveyed through the first fluid pathway is removed from the animal body using hemofiltration.

47. A method according to claim 43, wherein the incoming fluid conveyed through the first fluid pathway is removed from the animal body using hemodialysis.

48. A method according to claim 43, wherein the incoming fluid conveyed through the first fluid pathway is removed from the animal body using hemodialysis and hemofiltration.

49. A method according to claim 43, wherein the incoming fluid comprises spent peritoneal dialysis solution, and wherein the replacement fluid comprising fresh peritoneal dialysis solution.

50. A method of processing blood comprising the steps of:

providing a fluid circuit assembly as defined in claim 1,

separating a targeted material from the blood,

conveying the targeted material into the first fluid pathway for processing, and

processing a replacement fluid for the targeted material in the second fluid pathway.

51. A method according to claim 50, wherein the separating step includes hemofiltration.

52. A method according to claim 50, wherein the separating step includes dialysis.

53. A method according to claim 50, wherein the separating step includes hemofiltration and hemodialysis.

54. A method according to claim 50, wherein the processing in the first and second fluid pathways occurs concurrently.

55. A method according to claim 50, wherein the processing of the targeted material in the first fluid pathway occurs, at least for a time period, in volumetric balance with the processing of replacement fluid in the second fluid pathway.

56. A fluid circuit assembly comprising:

a first fluid pathway including a first fluid-receiving chamber and a first pump region operating in association with an external pump device for conveying fluid into the first fluid-receiving chamber,

a second fluid pathway including a second fluid-receiving chamber and a second pump region operating in association with an external pump device for conveying fluid into the second fluid-receiving chamber,

an element to hold the first and second fluid-receiving chambers in overlapping alignment so that fluid conveyed by the operation of the first pump region into the first fluid-receiving chamber displaces fluid from the second fluid-receiving chamber, and vice versa, and

a flow bypass region associated with at least one of the first and second pump regions to circulated fluid in a path outside the respective first and second fluid-receiving chamber when the respective first and second fluid-receiving chamber is filled with fluid.

57. An assembly according to claim 56, wherein the flow bypass region includes a normally closed valve element that opens in response to pressure when the respective first and second fluid-receiving chamber is filled with fluid.

58. An assembly according to claim 56, wherein the first and second pump regions each includes a peristaltic pump tube for operative association with external peristaltic pump rotors.

59. As assembly according to claim 58, wherein the

element holds the peristaltic pump tubes in alignment for concurrent operative engagement with the external peristaltic pump rotors.

60. An assembly according to claim 58, wherein the peristaltic pump tube of the first pump region has a diameter different than the peristaltic pump tube of the second pump region.

61. An assembly according to claim 56, wherein the first and second fluid receiving chambers each has a height of no greater than about 5 inches and a width of no greater than about 2.75 inches.

62. An assembly according to claim 61, wherein the first and second fluid receiving chambers each has a height of about 3.6 inches and a width of about 1.2 inches.

63. An assembly according to claim 56, wherein the flow bypass region has an inlet formed to present a channel width of no greater than about 0.6 inch.

64. An assembly according to claim 56, wherein the first and second fluid-receiving chambers are formed in the first and second fluid pathways between sheets of flexible material.

65. An assembly according to claim 56, wherein the first and second fluid-receiving chambers are formed in the first and second fluid pathways by radio frequency sealing of flexible material.

66. An assembly according to claim 56, wherein the first fluid pathway includes an inlet to receive a first fluid, and

wherein the second fluid pathway includes an inlet to receive a second fluid that is different than the first fluid.

67. An assembly according to claim 56, wherein the element comprises a frame holding the first and second fluid pathways.

68. An assembly according to claim 56, wherein the element comprises a cartridge holding the first and second pathways in overlapping alignment for mounting as an integrated unit on a fluid processing machine.

69. An assembly according to claim 68, further including at least one external tubing communicating with at least one of the first and second fluid pathways, and wherein the cartridge holds the tubing in alignment with the at least one first and second fluid pathway.

70. An assembly according to claim 56, wherein the first and second fluid pathways are configured to support a blood processing procedure.

71. An assembly according to claim 56, wherein the first and second fluid pathways are configured to support a fluid exchange procedure.

72. An assembly according to claim 56, wherein the first and second fluid pathways are configured to support a fluid balancing procedure.

73. An assembly according to claim 56, wherein the first and second fluid pathways are configured to support a hemofiltration procedure.

74. An assembly according to claim 56, wherein the first and second fluid pathways are configured to support a hemodialysis procedure.

75. An assembly according to claim 56, wherein the first and second fluid pathways are configured to support a hemodialysis with hemofiltration procedure.

76. An assembly according to claim 56, wherein the first and second fluid pathways are configured to support a peritoneal dialysis procedure.

77. A method of processing fluid to and from an animal body comprising the steps of:

providing a fluid circuit assembly as defined in claim 56,

conveying an incoming fluid removed from the animal body through the first fluid pathway and into the first fluid-receiving chamber, and

conveying a replacement fluid for the incoming fluid through the second fluid pathway and into the second fluid-receiving chamber,

conveying the replacement fluid from second fluid-receiving chamber to the animal body in response to the conveyance of the incoming fluid into the first fluid-receiving chamber, and

conveying the incoming fluid from first fluid-receiving chamber in response to the conveyance of replacement fluid into the second fluid-receiving chamber.

78. A method according to claim 77, wherein the incoming fluid conveyed through the first fluid pathway is removed from

the animal body using hemofiltration.

79. A method according to claim 77, wherein the incoming fluid conveyed through the first fluid pathway is removed from the animal body using hemodialysis.

80. A method according to claim 77, wherein the incoming fluid conveyed through the first fluid pathway is removed from the animal body using hemodialysis and hemofiltration.

81. A method according to claim 77, wherein the incoming fluid comprises spent peritoneal dialysis solution, and wherein the replacement fluid comprising fresh peritoneal dialysis solution.

82. A method of processing blood comprising the steps of:

providing a fluid circuit assembly as defined in claim 56,

separating a targeted material from the blood,

conveying the targeted material through the first fluid pathway and into the first fluid-receiving chamber, and

conveying a replacement fluid for the targeted material through the second fluid pathway and into the second fluid-receiving chamber,

conveying the replacement fluid from second fluid-receiving chamber in response to the conveyance of the targeted material into the first fluid-receiving chamber, and

conveying the targeted material from first fluid-receiving chamber in response to the conveyance of replacement fluid into the second fluid-receiving chamber.

83. A method according to claim 82, wherein the separating step includes hemofiltration.

84. A method according to claim 82, wherein the separating step includes dialysis.

85. A method according to claim 82, wherein the separating step includes hemofiltration and hemodialysis.

86. A fluid processing system comprising:

a fluid processing machine including a panel carrying hardware elements comprising an inlet valve assembly, an outlet valve assembly, and spaced first and second pumping elements, and

a disposable fluid processing circuit comprising

a first fluid pathway defined between sheets of flexible material including an in-line first fluid-receiving chamber having a chamber inlet and a chamber outlet, and a first pump region for conveying fluid into the first fluid-receiving chamber,

a second fluid pathway defined between sheets of flexible material including an in-line second fluid-receiving chamber having a chamber inlet and a chamber outlet, and a second pump region for conveying fluid into the second fluid-receiving chamber, and

a cartridge holding the first and second fluid pathways for mounting as an integrated unit on the panel, the cartridge holding the first and second fluid-receiving chambers in overlapping alignment for concurrent operative association between the chamber inlets and the inlet valve assembly and between the chamber outlets and the outlet valve assembly, respectively, the cartridge also holding the first and second pump regions in a spaced alignment for concurrent operative association with the first and second pumping elements, respectively, the concurrent operative associations among the first and second fluid pathways of the disposable fluid circuit and hardware elements of the machine occurring simultaneously with the mounting of the cartridge on the panel.

87. A system according to claim 86, wherein the first fluid pathway includes an inlet to receive a first fluid, and wherein the second fluid pathway includes an inlet to receive a second fluid that is different than the first fluid.

88. A system according to claim 86, wherein operation of the first pumping element to convey fluid into the first fluid-receiving chamber discharges fluid from the second fluid-receiving chamber, and vice versa.

89. A system according to claim 86, wherein the hardware elements includes a sensor, and wherein at least one of the first and second fluid pathways includes a sensing region, and wherein the cartridge holds the sensing region for operative association with the sensor simultaneously with the concurrent operative associations defined in claim 86.

90. An assembly according to claim 86, wherein the fluid circuit includes at least one external tubing communicating with at least one of the first and second fluid pathways, and wherein the cartridge holds the tubing in alignment with the at least one first and second fluid pathway.

91. An assembly according to claim 86, wherein the first and second fluid pathways are configured to support a blood processing procedure.

92. An assembly according to claim 86, wherein the first and second fluid pathways are configured to support a fluid exchange procedure.

93. An assembly according to claim 86, wherein the first

and second fluid pathways are configured to support a fluid balancing procedure.

94. An assembly according to claim 86, wherein the first and second fluid pathways are configured to support a hemofiltration procedure.

95. An assembly according to claim 86, wherein the first and second fluid pathways are configured to support a hemodialysis procedure.

96. An assembly according to claim 86, wherein the first and second fluid pathways are configured to support a hemodialysis with hemofiltration procedure.

97. An assembly according to claim 86, wherein the first and second fluid pathways are configured to support a peritoneal dialysis procedure.

98. A flow management system, comprising:

first and second sheets of material sealed to form a first panel, first and second sheets of material sealed to form a second panel, the first panel having a first fluid pathway for passing a first fluid comprising a first compartment to receive a volume of the first fluid, the second panel having a second fluid pathway for passing a second fluid comprising a second compartment to receive a volume of the second fluid,

the panels being aligned so that the first compartment overlays the second compartment to form a structure so that the first fluid from the first compartment is displaced as the second fluid fills the second compartment when the panels are aligned and placed between a first surface and a second surface defining a gap.

99. The flow management system of claim 98, wherein the panels are die cut and overlay one another.

100. The flow management system of claim 98, wherein the sheets are flexible.

101. The flow management system of claim 98, wherein each panel has a pattern of seals.

102. The flow management system of claim 98, wherein the first fluid is an outgoing fluid.

103. The flow management system of claim 98, wherein the second fluid is an in-going fluid.

104. A flow management system, comprising

a first panel having a first fluid pathway for passing a first fluid, the first panel comprising a first compartment to receive a volume of the first fluid and a second compartment to receive a volume of the first fluid; and

a second panel having a second fluid pathway for passing a second fluid, the second panel comprising a third compartment to receive a volume of the second fluid and a fourth compartment to receive a volume of the second fluid,

the panels being aligned so that the first compartment overlays the third compartment to form a structure so that, when the panels are aligned and placed between a first surface and a second surface defining a gap, the first fluid from the first compartment is displaced as the second fluid fills the third compartment, and the second compartment overlays the fourth compartment to form a structure so that the second fluid from the fourth compartment is displaced as the first fluid fills the second compartment.

105. The flow management system of claim 104, wherein the panels are die cut and overlay one another.

106. The flow management system of claim 104, wherein the panels are flexible.

107. The flow management system of claim 104, wherein each panel has a pattern of seals.

108. The flow management system of claim 104, wherein the first fluid is an outgoing fluid.

109. The flow management system of claim 104, wherein the

second fluid is an in-going fluid.

110. A flow management system, comprising:

a first panel having a fluid pathway for passing a first fluid, the first panel comprising a first compartment to receive a volume of the first fluid;

a second panel having a fluid pathway for passing a second fluid, the second panel comprising a second compartment to receive a volume of the second fluid, the first and second panels being aligned so that the first compartment overlays the second compartment; and

a first surface and a second surface defining a gap, the first and second compartments disposed within the gap so that the second compartment bears against the second surface as the second fluid fills the second compartment and forces the first fluid out from the first compartment as the first compartment bears against the first surface.

111. The flow management system of claim 110, wherein the first panel further comprises a third compartment to receive a volume of the first fluid.

112. The flow management system of claim 110, wherein the second panel further comprises a fourth compartment to receive a volume of the second fluid.

113. The flow management system of claim 110, wherein the panels are aligned by folding.

114. The flow management system of claim 110, wherein the panels are die cut and overlay one another.

115. The flow management system of claim 110, wherein the panels are flexible.

116. The flow management system of claim 110, wherein each panel has a pattern of seals.

117. The flow management system of claim 110, wherein the first fluid is an outgoing fluid.

118. The flow management system of claim 110, wherein the second fluid is an in-going fluid.

119. A flow management system, comprising:

a first panel having a fluid pathway for passing a first fluid, the first panel comprising a first compartment to receive a volume of the first fluid, the first compartment communicating with first and second channels; and

a second panel having a fluid pathway for passing a second fluid, the second panel comprising a second compartment to receive a volume of the second fluid, the second compartment communicating with third and fourth channels,

the panels being aligned so that the first compartment overlays the second compartment, the first channel overlays the third channel, and the second channel overlays the fourth channel, so that the first fluid passes out through the first channel as the second fluid passes in through the third channel without mixing of the first and second fluids.

120. The flow management system of claim 119, wherein the first fluid from the first compartment is displaced as the second fluid fills the second compartment.

121. The flow management system of claim 22, further comprising a first surface and a second surface defining a gap, the first and second compartments disposed within the gap so that the second compartment bears against the second surface as the second fluid fills the second compartment and forces the first fluid out from the first compartment.

122. The flow management system of claim 119, wherein the first panel further comprises a third compartment to receive a volume of the first fluid.

123. The flow management system of claim 119, wherein the second panel further comprises a fourth compartment to receive a volume of the second fluid.

124. The flow management system of claim 119, wherein the panels are aligned by folding.

125. The flow management system of claim 119, wherein the panels are die cut and overlay one another.

126. The flow management system of claim 119, wherein the panels are flexible.

127. The flow management system of claim 119, wherein each panel has a pattern of seals.

128. The flow management system of claim 119, wherein the first fluid is an outgoing fluid.

129. The flow management system of claim 119, wherein the second fluid is an in-going fluid.

130. A flow management system, comprising:

a first panel having a fluid pathway for passing a first fluid, the first panel comprising a first compartment to receive a volume of the first fluid, the first compartment communicating with first and second channels;

a second panel having a fluid pathway for passing a second fluid, the second panel comprising a second compartment to receive a volume of the second fluid, the second compartment communicating with third and fourth channels, the panels being aligned so that the first compartment overlays the second compartment, the first channel overlays the third channel, and the second channel overlays the fourth channel; and

a releasable clamp that bears against the first channel and the third channel to close the first and third channels.

131. The flow management system of claim 130, wherein the releasable clamp is a solenoid clamp.

132. The flow management system of claim 130, wherein the releasable clamp is a spring loaded clamp.

133. The flow management system of claim 130, wherein the first fluid from the first compartment is displaced as the second fluid fills the second compartment.

134. The flow management system of claim 130, further comprising a first surface and a second surface defining a gap, the first and second compartments disposed within the gap so that the second compartment bears against the second surface as the second fluid fills the second compartment and

forces the first fluid out from the first compartment.

135. A method for monitoring pressure in a blood processing system, comprising the steps of:

passing a fluid through a panel having a fluid channel, the channel having an inside surface that contacts the fluid and an outside surface, and being formed of a flexible material that distributes pressure evenly;

contacting a pressure meter with the outside surface of the fluid channel; and

operating the pressure meter to measure the pressure of the fluid passing through the fluid channel.

136. A method for detecting a blood leak in a blood processing system, comprising the steps of:

passing a fluid through a panel having a fluid channel, the channel having an inside surface that contacts the fluid and an outside surface;

positioning an optical detector adjacent the outside surface of the fluid channel;

operating the optical detector to measure the absorption spectrum of the fluid passing through the fluid channel; and

comparing the measured spectrum to the known spectrum for the fluid to determine whether the fluid is contaminated with blood.

137. A flow management system, comprising:

a panel having a fluid pathway for passing a fluid, the panel comprising a compartment to receive a volume of the fluid, the compartment communicating with a channel that communicates with a fluid source and a recirculation port; and

a releasable clamp that bears against the recirculation port to close the recirculation port, wherein fluid passes from the source and through the channel until the compartment is filled, and excess fluid passes through the recirculation port by releasing the clamp.

138. The flow management system of claim 137, wherein the releasable clamp is a spring loaded clamp.

139. The flow management system of claim 137, wherein excess fluid is returned to the fluid source.

140. The flow management system of claim 137, wherein fluid is pumped from the source and through the channel until the compartment is filled.

141. The flow management system of claim 137, wherein the fluid source comprises a length of tubing in registry with a rotor pump.

142. A fluid balancing system comprising:

a chamber having a volume;

an inflow channel that communicates with the chamber;

an outflow channel that communicates with the chamber;

a pump on at least one of the inflow channel or the outflow channel that delivers a pump volume per turn and that operates at a speed; and

a valve that operates to close and open the outflow channel and that cycles between closed and open positions at a rate, wherein the pump speed and rate of valve operation is synchronized so that the number of pump turns per valve operation is approximately equal to the volume of the chamber divided by the pump volume per turn.

143. The fluid balancing system of claim 142, wherein the valve comprises a pinch clamp.

144. The fluid balancing system of claim 142, further comprising a valve that operates to close and open the outflow channel.

145. The fluid balancing system of claim 142, wherein the number of pump turns per valve operation is approximately 5:1.

146. The fluid balancing system of claim 142, wherein the volume of the chamber divided by the pump volume per turn is approximately 5.

147. The fluid balancing system of claim 142, wherein the pump bears against a length of tubing that communicates with

at least one of the inflow channel or the outflow channel.

148. The fluid balancing system of claim 142, wherein the pump is a roller pump.

149. A flow management system, comprising:

first and second sheets of material sealed to form a first panel, first and second sheets of material sealed to form a second panel, the first panel having a first chamber having a volume, an inflow channel that communicates with the first chamber, and an outflow channel that communicates with the first chamber, the second panel having a second chamber having a volume, an inflow channel that communicates with the second chamber, and an outflow channel that communicates with the second chamber;

the panels being aligned so that the first chamber overlays the second chamber to form a structure so that the first fluid from the first chamber is displaced as the second fluid fills the second chamber when the panels are aligned and placed between a first surface and a second surface defining a gap;

a first pump on at least one of the inflow channel or the outflow channel of the first chamber that delivers a pump volume per turn and that operates at a speed

a second pump on at least one of the inflow channel or the outflow channel of the second chamber that delivers a pump volume per turn and that operates at a speed; and

a first valve that operates to close and open the outflow channel to the first chamber and the inflow channel to the second chamber and that cycles between closed and open positions at a rate, and a second valve that operates to close and open the inflow channel to the first chamber and the outflow channel to the second chamber and that cycles between closed and open positions at a rate, the outflow channel to the first chamber and the inflow channel to the second chamber

being open when the inflow channel to the first chamber and the outflow channel to the second chamber are closed, wherein the pump speed and rate of valve operation is synchronized so that the number of pump turns per valve operation is approximately equal to the volume of the chamber divided by the pump volume per turn.

150. The fluid balancing system of claim 149, wherein the first valve comprises a pinch clamp and the second valve comprises a pinch clamp.

151. The fluid balancing system of claim 149, wherein the number of pump turns per valve operation is approximately 5:1.

152. The fluid balancing system of claim 149, wherein the volume of the chamber divided by the pump volume per turn is approximately 5.

153. The fluid balancing system of claim 149, wherein the first pump bears against a length of tubing that communicates with at least one of the inflow channel or the outflow channel of the first chamber, and the second pump bears against a length of tubing that communicates with at least one of the inflow channel or the outflow channel of the second chamber.

154. The fluid balancing system of claim 149, wherein the first pump is a roller pump and the second pump is a roller pump.

155. A method for fluid processing, comprising the steps of:

providing a fluid balancing system as set forth in claim 149;

inputting a fluid to the first chamber through the inflow channel to the first chamber while the first valve is closed and the second valve is open until the first chamber substantially fills;

opening the first valve and closing the second valve;

inputting a fluid to the second chamber through the inflow channel to the second chamber while the first valve is open and the second valve is closed until the second chamber substantially fills and the first chamber substantially empties, wherein the pump speed and rate of valve operation is synchronized so that the number of pump turns per valve operation is approximately equal to the volume of the chamber divided by the pump volume per turn.